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(12) # APPLICATION FOR INVENTION PATENT

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(54) New endo-buccal prostheses in composite materials.

(57) Such prostheses are used in the implementation of tenons 2 for reconstructive inlays or built up tooth stumps.

They are created from composite materials reinforced with high resistance fibers and exhibit perfect bio-compatibility. Such fibers may be carbon fibers or fibers selected from among glass, ceramic, boron, boron carbide or silicon carbide fibers, or aromatic polyamide fibers; and they are imbedded in resins in the form of composite materials, such resins being selected from among the epoxy or polyester resins.

These prostheses eliminate the need for using any metal inside the mouth and thus eliminate all oxidation problems as well as the dispersal of metal ions into the body that are associated with the use of metal.

/FIGURES/

This invention concerns new endo-buccal prostheses applicable in particular as fixed protheses, to crown, root and root-crown prosthetic reconstructions, to partial and total associated prostheses, to base plates and clasps, and to all endo-buccal surgical prostheses, as will be explained further on.

It is known that the bulk of techniques currently used in odontology in cases of reconstruction of fixed dental elements make use of multiple and varied metal alloys the interactions of which are not always precisely controlled.

It is thus that, in the case of the direct method of reconstruction, the use of a tenon of a precious metal or base metal alloy in conjunction with a precious metal or base metal alloy casting can entail corrosion phenomena. Moreover, the thermal and mechanical constraints operating can lead to structural changes, phenomena aggravated in an anaerobic environment.

Reconstruction following the indirect technique requires the taking of an impression, often a long and disagreeable process for the patient, and the making of a positive from that impression, with all the possibilities for errors owing to handling. It is then necessary to make a casting in the laboratory, a lengthy and expensive technique requiring a high degree of precision so as not to bring about structural changes in the alloys. These critical imperatives of casting: temperature, quality of coating, are difficult to satisfy.

There, one finds himself in the presence of an important association of metal components which leads to corrosion and oxidation phenomena.

Through oxidization, there can even be a dispersal of metal ions throughout the body, especially from nickel used in base metal alloys. The use of base metal alloys is prohibited, by the way, in certain countries by their ministries of health.

The current techniques of emplacement of an esthetic cap to reinforce or replace he dental organ also present numerous inconveniences. In effect, when such caps are made without metal armatures, the lack of rigidity can lead to a fracturing of the prosthesis.

In another vein, thermal shocks engender changes in cervical volume from

which can come infiltration or loosening of the cement. Added to this, there are also risks of recurrent caries and infection for the dental support element.

Where prostheses are made with metal armatures, a casting must be made in the laboratory, requiring a lengthy and expensive technology. There is always the presence of the already enumerated hazards owing to base metal alloys. And finally, with the use of organic and composite resin cosmetics, there is no linkage with the metal, from which arises the necessity to add mechanical retainers which more or less well fulfill their role of adherence.

On another tack, the failures with implants currently acknowledged are, in large part, owing to insufficient bio-compatibility of the materials used, bringing about the rejection of the prosthetic element and, in particular, not allowing the formation of a natural, effective and durable seal between the salivary and the intraosseous environments, leaving a portal open to bacterial penetration, whatever the form of implant used, and bringing about the rejection of the prosthetic element.

And finally, in the case of preservative odontology, all the methods used to augment the stability and retention of large obturations present inconveniences owing to lack of co-adaptation between the restoration materials and the means of retention, which entails zones of fragility.

Thus, in the case of use of a cemented tenon or screw post, only the mechanical link between the dental element and the obturation is assured, to the exclusion of any physical or chemical bond.

The present invention has the objective of alleviating the inconveniences enunciated above by proposing new endo-buccal prostheses which eliminate the use of any metal in the mouth.) we do not intend to ~~[illegible]~~ BAN USE OF metal IN mouth ONLY POSTS

According to the invention, these new prostheses are essentially constituted of high-resistance fibers, particularly carbon fibers, possibly included within resins in the form of composite materials.

These new prostheses offer excellent resistance to breakage, high rigidity, good fatigue behavior, and high stability in the face of thermal and buccal shocks.

Moreover, they present total bio-compatibility, which has been established in

the course of numerous cell culture tests. Tests in saliva have failed to reveal any dispersal of any element from the fiber-composite material association.

The present invention will now be described, and its advantages will indeed emerge from the description that follows by reference to the schematic drawing attached, in which:

– Figures 1 and 2 are longitudinal section views of one method of embodiment of the invention applied to reconstructive inlays;

– Figures 3 and 5 are longitudinal section views of two methods of realization of the expandable tenons according to the invention;

– Figures 4 and 6 are sectional views following IV-IV and VI-VI of figures 3 and 5 respectively;

– Figure 7 is a longitudinal section view of a cup intended for the realization of a reinforcing esthetic cap;

– Figures 8, 9 and 10 are longitudinal section views of cups according to figure 7 mounted on devices intended to facilitate their application.

On the figures, 1 represents in a general manner the dental organ which it is desired to reinforce, and 2 represents the prosthesis according to the invention.

In the method of embodiment represented in figures 1 through 5, the prosthesis 2 according to the invention is used to create tenons intended for reconstructive inlays or prepared stumps.

The tenon 2 represented in figures 1 and 2 is a simple, monobloc tenon comprising a cylindrical part 3 connected to a part 4 which is geometrically similar to the drill used to prepare the lodging 5 of the said tenon in the tooth 1. This assures a perfect matching of the assembly, requiring a minimum thickness of sealing cement between the tooth and the tenon during cementing, in the conventional manner, with an epoxy or photopolymerizable resin.

According to the invention, the tenon 2 is created from composite materials reinforced by high resistance fibers. By preference, such are carbon fibers. They may also be any fibers which present a similar resistance and perfect bio-compatibility, selected for example from among glass, ceramic, boron, boron carbide or silicon carbide fibers, as well as among the new synthetic fibers of the aromatic

polyamide type.

This tenon may be obtained by the implementation of several methods.

One may, in effect, mechanically machine cylindrical bars constituted of bundles of fiber assembled in a resin matrix. Such fibers may be found in the form of a bundle of parallel fibers, possibly lapped. They may also be in the form of woven, knitted or braided fabric.

Similarly, the partially or totally polymerized resin may be selected from among various thermosetting resins such as the epoxy or polyester resins.

The tenons may also be obtained by molding the above described materials—whether molding by pultrusion, injection, compression, transfer, or by some combination of those methods of molding.

And finally, a core can be coated by dipping it in resin, followed by flocking using cut fibers and polymerization in a suitable mold.

On figure 2 is seen the mounting of a reconstructive inlay 6 on a stump 1 fitted with a tenon 2 according to the invention.

The methods of embodiment represented in figures 3 through 6 show various expandable hollow tenons provided in order to reduce as much as possible the gap between the tooth 1 and the tenon 2 and thus minimize the amount of cement needed to ensure the bonding of the two elements.

It is thus that the monobloc tenon represented in figures 3 and 4 is constituted of a hollow element 2 of the "goose quill" type, made, according to the invention, of carbon fiber reinforced composite material. That hollow element is then plugged by the introduction of a solid tenon 7 having a lesser diameter than element 2, and which may be made of the same material or any other suitable material.

Figures 5 and 6 represent a hollow, expandable tenon 2 composed of the several assembled parts 2a, 2b and 2c made of composite material reinforced by carbon fibers according to the invention and into which is introduced a conical core 8 intended, as with the previous methods of embodiment, to ensure the expansion of the tenon once it is placed in the tooth.

One can conceive all the advantages rendered by application of the composite material according to the invention to the creation of these tenons, which, first of

all, enable elimination of the use of any alloys or metals and the inconveniences directly linked thereto: corrosion, dispersal into the body of metal ions. The material used presents perfect bio-compatibility.

Realization directly in the mouth without taking impressions eliminates all work in the laboratory, especially the complicated techniques of metal casting.

The tenon made of composite material according to the invention adheres perfectly to the reconstructive composite material, resulting in better retention and greater resistance.

Figure 7 illustrates the application of prostheses according to the invention in the creation of an esthetic cap to reinforce or replace the dental organ.

In this case also, all metal elements are eliminated and replaced by a cup 20 made of material according to the invention which is intended to support the cosmetic element 9.

The cup 20 is fashioned from semi-finished carbon fiber products which can be found in the form of filamentary rolls, of woven, knitted or braided fabric or cut fibers in the mass. The methods of realization of the cups can be quite varied. They can be created by cutting a tubular braid, with a folded back cuff and cementing of the cut ends. A cup thus obtained can then be mounted (figure 8) on an internal mandril 10, possibly providing adjustable cuffs on the edges of the cup 20 toward the interior or toward the exterior, thus enabling the practitioner to adjust the height of the cup at will.

The cup may also be mounted (figure 9) on an external mandril 11, the edges of the said cup also being folded back toward the interior or the exterior. Thus, the stocking and handling of the cup is facilitated. In a case where the external mandril is deformable, the putting in place of the cup can be effected under the pressure of the fingers or an appropriate instrument by turning it inside out, directly in the mouth or outside of the mouth.

And finally, in the method of realization represented in figure 10, the cup 20 is mounted inside a body 12 which is deformable and transparent and intended to facilitate the placement in the mouth of the said cup 20. If it is not desired to leave the body 12-cup 20 assembly in place in the mouth (or outside the mouth),

the internal face of the deformable body 12 is rendered non-sticking by coating it with a compatible anti-adhesive or the interposition of a protective film of teflon, polyethylene or any other material which is non-adhesive to the carbon matrix system.

The deformable body 12, itself made of any known material, enables pressing the cup 20 against the tooth 1 to be treated, a layer of cement being interposed between the two elements, the assembly being held in place using forceps 13, and the patient exerting pressure by means of the opposing tooth 14.

It is thus possible to immediately and without intermediate molding adapt the adjust the bite.

The cup may also be obtained by injection modeling /Sic/ or by compression of carbon fiber filled resin.

Once placed and affixed in the mouth, it is covered with a cosmetic element 9 which is bonded by cementing in place (figure 7).

In a case of multiple prostheses, the bridge beam(s) provided to receive the cosmetic element of the missing tooth or teeth may also be made of carbon fibers, possibly in the form of woven, knitted or braided fabric, which are cemented to the cup of the supporting teeth before the cosmetic element is put in place.

The carbon fibers, in the form of woven, knitted or braided fabric, also find highly interesting use in partial or total associated prostheses, by inclusion as reinforcement in the resins currently used. Carbon fabric can also serve as a base for an associated prosthesis.

And in the end, the problems of adhesion which present themselves in dento-facial orthopedics can be resolved by replacing the metal or resin-based screws currently used by screws machined from plates of woven, knitted or braided carbon fibers.

The new prostheses according to the invention are also adapted to fitting cemented bridges.

And finally, these new prostheses can be applied to implants following a technique to be accomplished in the laboratory with cultured tissue taken from the patient, on a reticulated carbon fiber implant prior to installing the assembly.

One conceives all the interest of the invention, which bestows a particularly interesting solution to the problems posed by the toxicity of certain dental alloys, while enabling esthetic, functional and durable reconstructions.

In effect, such reconstructions are of the same nature from the cemented internal part right up to the superstructure or external part.

CLAIMS

1 – Endo-buccal prostheses, characterized in that they are essentially constituted of high resistance fibers presenting perfect bio-compatibility.

2 – Endo-buccal prostheses according to claim 1, characterized in that the high resistance fibers are carbon fibers.

3 – Endo-buccal prostheses according to claim 1, characterized in that the high resistance fibers are selected from among glass, ceramic, boron, boron carbide or silicon carbide fibers, as well as from among fibers of the aromatic polyamide type.

4 – Endo-buccal prostheses according to claims 1 through 3, characterized in that the high resistance fibers are included in resins in the form of composite materials.

5 – Endo-buccal prostheses according to claim 4, characterized in that the resins are selected from among the epoxy and polyester resins.

6 – Application of prostheses according to any one of claims 1 through 5 to the creation of tenons for reconstructive inlays.

7 – Application of prostheses according to any one of claims 1 through 5 to the creation of cups for reinforcing esthetic caps.

8 – Application of prostheses according to any one of claims 1 through 5 to the creation of cemented bridges.

9. Application of prostheses according to any one of claims 1 through 5 to the realization of implants.

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CERTIFICATE OF ACCURACY

STATE of New York) SS:
County of New York)

Gertrud Mathys being duly sworn, deposes and says that she is the President of Translation Company of America, 10 West 37th Street, New York, NY 10018 and that she is thoroughly familiar with MARIE MIJOUE **who translated the attached document relating to:**

THE APPLICATION FOR INVENTION PATENT, NATIONAL REGISTRATION NUMBER: 85 15527.

from the FRENCH **language into the** ENGLISH **language, and that the** ENGLISH **text is a true and correct translation of the original, to the best of her knowledge and belief.**

Sworn before me this
28TH day of FEBRUARY **1997**

Notary Public

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